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ECOLOGICAL LAND CLASSIFICATION
OF
POLICE OUTPOST PROVINCIAL PARK
AND OUTPOST WETLANDS NATURAL AREA

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ECOLOGICAL LAND CLASSIFICATION OF POLICE OUTPOST PROVINCIAL PARK AND OUTPOST WETLANDS NATURAL AREA

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EXECUTIVE SUMMARY

Police Outpost Provincial Park and Outpost Wetlands Natural Area are situated about 30 km southwest of Cardston, Alberta, within the Foothills Parkland Natural Subregion (Achuff 1994). The Provincial Park consists of 223 ha of gently rolling land bordering Outpost Lake, and the Natural Area encompasses about 65 ha of land adjacent to Outpost Wetlands. The southern boundary of both protected areas is the Canada - United States international border.

Many important natural features exist within the study area, including native fescue grasslands, an extensive wetland area, a diverse assemblage of plant species, and several rare plants. In order to provide background data for management plans to help protect these resources, the Resource Data Division was requested to conduct a biophysical inventory and ecological land classification in the study area. The specific objectives of the study were:

1. To provide an ecological land classification and biophysical map of the study area, showing vegetation types matched to physical land units;
2. To classify and describe vegetation community types within the study area;
3. To identify and describe significant natural features in the study area.

Based on vegetative composition and associated environmental (landscape, soil) conditions, sixteen vegetation community types were identified, including deciduous forest types, shrublands, native grasslands, disturbance communities, and wetlands. Deciduous forests consist of aspen (*Populus tremuloides)* or balsam poplar (*P. balsamifera)*, with a shrub layer of varied composition, depending on soil moisture characteristics. The native grasslands are dominated by rough fescue (*Festuca campestris)*, although Kentucky bluegrass (*Poa pratensis)* also forms a substantial proportion of the grass cover. Outpost Wetland represents a large expanse of emergent vegetation, supporting an interesting assemblage of wildlife. This is a diverse and extensive marsh system, and a very valuable natural resource.

The study area is noted for its rich flora, including a substantial number of significant plant species. However, a non-native species, smooth brome (*Bromus inermis)*, which was historically planted as a forage species, appears to be spreading. Smooth brome invasion appears to be most significant in the Natural Area.

Several landscape complexes or major ecosystems of importance in the province's protected areas planning system (Achuff 1994) are found in the study area. Important features include exposed and protected slopes associated with the rolling glacial till, the glaciofluvial outwash channel occupied by Outpost Wetland, several springs and intermittent streams, wet meadows, marshes and Outpost Lake.

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Ian Sutherland and Steve Gaylor, Resource Data Division, Calgary, co-ordinated the project;

From Resource Data Division, Edmonton: Bob Skoye created an initial digital orthophoto base map, Bob Sleep prepared the final digital orthophoto base map, Alan Benner completed the final cartography on this base, and Lucy Faferek digitized the final maps.

John Rintoul, Alberta Natural Heritage information Centre, Parks and Protected Areas, Edmonton, provided significant features database records.

DISCLAIMER

Evaluation of the status of flora and fauna in the study area is based on 1996 definitions and categorized lists of species of concern (ANHIC 1996, COSEWIC 1996 and Alberta Environmental Protection 1996). However, these lists are periodically updated, based on new information or a change in species status. For example, some species which were considered relatively secure may now be included in more recent lists of species of concern. The information collected during this study was recorded on field plot forms which are stored at the Alberta Resource Data Division office in Edmonton. These data need to be reviewed and re-evaluated in light of possible changes in the recognized status of species.

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1.0 INTRODUCTION

Police Outpost Provincial Park and Outpost Wetlands Natural Area are protected areas nestled among rolling hills in southwest Alberta, just north of the Canada - United States boundary. This is one of the few foothills parkland areas that is officially protected, and is of immense value within the province's protected areas system.

A diversity of vegetation types occurs, including native fescue grassland, aspen woodland and wetlands. Because of its location in a narrow transitional belt between prairie (Grasslands Natural Region) and higher elevational areas of the Rocky Mountain Natural Region, the area is very rich in plant species. Several rare plant species occur in the study area, including those of national significance.

To provide background information useful in the management and protection of natural resource features in the study area, the Resource Data Division of Alberta Environmental Protection was requested to conduct a study, with the following objectives:

1. to create an ecological land classification and biophysical map of the study area, showing vegetation types matched to physical land units;
2. to classify and describe vegetation community types within the study area;
3. to identify and describe significant natural features in the study area.

An ecological land classification integrates information about the biological and physical features of an area, recognizing a wide spectrum of environmental influences on ecosystems. According to Hills (1976), the objective of an ecological land classification is to subdivide a land area into discrete units which are located and identified based on ecologically significant similarities. Because this approach integrates many types of environmental information, it is particularly useful as a framework for environmental resource management and planning.

2.0 STUDY AREA DESCRIPTION

2.1 Location and History

The study area is located in southwest Alberta, about 30 km southwest of Cardston (Fig. 1), and includes Police Outpost Provincial Park (223 ha) and Outpost Wetlands Natural Area (65 ha). These areas of protected crown land lie adjacent to each other and encompass all or portions of the following lands:

> Police Outpost Provincial Park: Section 6, Township 1, Range 26, west of the 4th Meridian. (excluding the waters of Outpost or Police Lake, but including the island within the lake);
>
> Outpost Wetlands Natural Area: Southeast quarter of Section 1, Township 1, Range 27, west of the 4th Meridian.

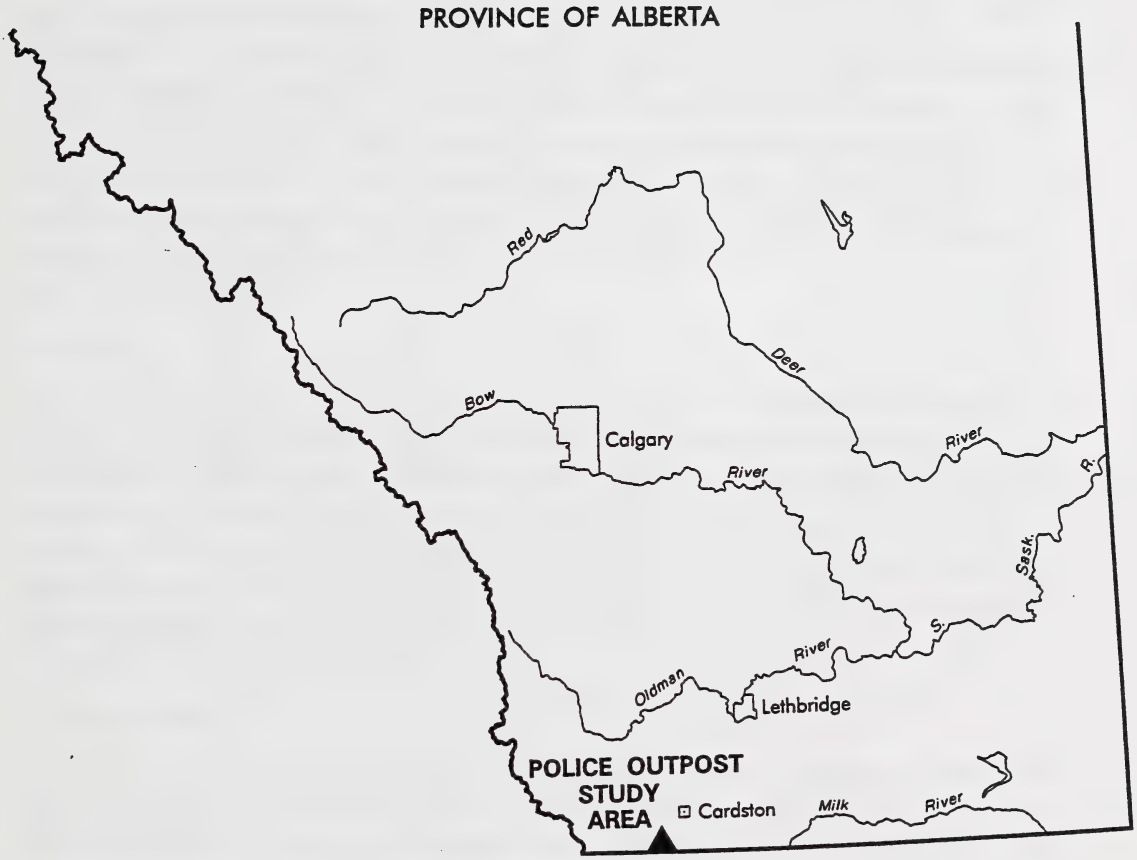

Figure 1. Location of the Police Outpost Study Area

Police Outpost Provincial Park consists of 223 ha of land adjacent to Outpost Lake (locally known as Police Lake). The park was established in 1970, with boundaries expanded to their current status in 1982. The name of the park is derived from the Northwest Mounted Police outpost which was operated near the lake from 1981 to 1899, to patrol the border and to help control whiskey smuggling. The outpost buildings are no longer in evidence. The area experienced moderate grazing prior to its protection, and parts of the south half of the park had been cultivated and seeded to non-native plant species.

Outpost Wetlands Natural Area is a quarter section (65 ha) of land just west of Police Outpost Provincial Park. It supports a very rich and valuable wetland, one of the largest in the area, as well as remnant fescue grassland and deciduous woodland. This piece of land was purchased in 1987 by Alberta Forestry, Lands and Wildlife and the Nature Conservancy of Canada. By this time, the area had experienced heavy grazing and some cultivation to non-native pasture. In recent years, the distribution of the non-native species has expanded, and has threatened several previously recorded populations of rare plants. Because of the species richness and with the diverse and extensive wetland, the site is considered a valuable contribution to the system of protected areas in Alberta.

2.2 Climate

Weather data were collected at a site near Carway, 6 km east and slightly lower in elevation (1358 m above sea level) than the study area. These data show that the study area is characterized by large temperature fluctuations, with fairly cold winters moderated by frequent chinooks (warm winds of low relative humidity) and warm dry summers. Rainfall averages 272 mm per year, with the most rain falling in June. Average monthly snowfall from December to April for the period from 1951 to 1980 was about 4 cm. Temperatures ranged from -44° C in December/January to almost 37° C in July (Environment Canada, n.d.). The frost-free period averages about 90 days (Achuff 1994).

2.3 Hydrography

Outpost Lake, a depression filled by local runoff, is about 103 ha in size (Alberta Parks 1989). It has a full surface level of 1379 m above sea level. It is stocked annually with trout, which provide sport fishing opportunities for park visitors. The level of the lake was artificially raised for irrigation purposes in 1927 by a control structure built by a local rancher at the natural outlet on the east shore. The control structure was replaced in 1972. The higher water levels flooded shoreline areas and created an island from a peninsula of land which had earlier been heavily utilized by cattle. The maximum depth of the lake is about 5 m, although most of the lake is about 2m deep (Alberta Parks 1989; MacNeill 1977).

Dissolved oxygen levels in the lake occasionally reach below levels critical to the survival of trout (Alberta Fish and Wildlife, unpubl. data, in Alberta Parks 1989). The lake is alkaline in pH. Several small intermittent streams flow into the lake, at the north, west and south shores.

Two shallow ponds, representing local watershed catchment basins, are found along the slope north of Outpost Wetlands. The two ponds are at about the same elevation (1401 and 1403 m), separated by a small saddle that has probably been submerged during past years of very high water levels. The seepage channel between these two ponds becomes saline as it intermittently dries out, and supports several halophytic (salt-tolerant) plant species. These ponds are less than one metre deep, and are characterized by an extensive cover of aquatic emergents such as common great bulrush (*Scirpus validus).* The eastern pond is rimmed by a narrow zone of willows (*Salix* spp.) and a few poplars (*Populus balsamifera).* There is no visible inlet, but the two ponds have a common outlet drainage via a small channel leading southwest into Boundary Creek.

Another pond straddles the boundaries of the Provincial Park and Natural Area. This pond is deeper and more permanent, and drains primarily eastward via a small intermittent creek into Outpost Lake. A mature poplar-willow community type has developed around its perimeter. Emergent vegetation covers about one third of the pond's surface. This pond provides nesting and feeding habitat for grebes and ducks, as well as habitat for mammals such as the long-tailed weasel (*Mustela frenata).*

Boundary Creek flows through the study area, in a west-northwesterly direction out of a large lake located south of the international boundary. The creek occupies a wide glacial meltwater channel. When water levels are sufficiently high, the creek floods an extensive area within the glaciofluvial channel, creating a very large and productive wetland (Outpost Wetland). Water flow in Boundary Creek is also modified by beaver activity.

Outpost Wetland occurs within the same large glacial meltwater channel occupied by Boundary Creek. Hydrologically, this wetland serves to maintain the water table and store water during dry periods (W. Langen, Alberta Env. Prot., pers. comm). Water levels in 1997 were very high (E. Friessen, local rancher, pers. comm.). A large expanse of emergent aquatic vegetation is supported in this wetland. Willows grow in somewhat drier parts of the wetland, as well as in a fringe along the wetland edges. The wetland provides critical habitat for a wide variety of wildlife species.

Several intermittent streams or springs drain into Outpost Lake or into Outpost Wetland. The better-than-average moisture conditions along these intermittent stream channels typically support rich willow/forb communities.

2.4 Physiography and Bedrock Geology

Gently to moderately rolling hills cover the study area, with some steeper slopes (up to about 40%) in the southwest part of the Park and of the Natural Area. Elevation varies from 1377 m above sea level in Outpost Wetland to about 1441 m on a ridge in the southwest part of Police Outpost Provincial Park.

The study area is classed within the Southern Foothills District of the Rocky Mountain Foothills Physiographic Region (Pettapiece 1986), in an area where glacial till of Cordilleran origin predominates (Brierley et al. 1991). Most of the study area is covered with a layer of glacial

deposits. However, sandstone bedrock outcrops occur on steeper slopes in the southwest part of Police Outpost Provincial Park. The Brazeau Formation is dominant under the study area, consisting primarily of sandstones of Tertiary age (Green 1972). The northwest-southeast trending ridge in the southwest part of the Park is indicative of the effects of thrust faulting associated with the uplift of the Rocky Mountains.

2.5 Surficial Geology and Parent Materials

Till is the dominant parent material in the study area (this study, Brierley et al. 1991). Glaciofluvial deposits underlie the glacial outwash channel occupied by Boundary Creek and Outpost Wetlands. In some parts of the outwash channel, the glaciofluvial deposits are interspersed with till deposits. Brierley et al. (1991) identified eskers in the study area, the most significant being in the Natural Area, northeast of Outpost Wetland.

Recent lacustrine deposits are associated with Outpost Wetlands and Outpost Lake, as well as the small ponds. Fluvial sediments occur along the intermittent stream channels.

2.6 Soils: Overview

Soil survey information was obtained from several sources. An intensive soil survey was conducted over part of the study area, the east half and northeast quarter of Police Outpost Provincial Park (Greenlee 1974). A more comprehensive, but less intensive, survey of the entire Municipal District by Brierley et al. (1991) resulted in descriptions and mapping of principal soil units. Information from these sources, coupled with detailed site/soils analyses carried out in 1997, was used to create the Ecological Land Classification map (Map 1). The soils information is summarized below.

Orthic Black Chernozems have developed over most of Police Outpost Provincial Park, that is, in the east part of the study area. At some sites, the chernozemic soils are very deep, with an Ah horizon over 1 m thick on local slopewash deposits. In the southwestern part of the study area, in Outpost Wetland Natural Area south and west of the wetland, Orthic Dark Gray Chernozemic soils are interspersed with Orthic Black Chernozems on the till and glaciofluvial deposits. Soil stoniness in the study area varies from slightly to excessively stony (Brierley et al. 1991, Greenlee 1974, this study).

On the northwest-southeast trending ridge in the southwest part of Police Outpost Provincial Park, the terrain is bedrock controlled. Here, soils are rapidly drained thin Rego-Black Chernozems over residual bedrock.

Pockets of poorly drained to very poorly drained soils are found throughout the study area. These saturated soils occur in Outpost Wetland, in seepage areas especially adjacent to Outpost Lake, and along intermittent stream channels, where Gleysols, most commonly Orthic Humic Gleysols, have developed.

2.7 Vegetation: Overview

The study area occurs within the Foothills Parkland Natural Subregion of the Parkland Natural Region (Achuff 1994). In the extreme southwest part of Alberta, the Foothills Parkland is a very narrow belt between the Montane Subregion (Rocky Mountain Natural Region) and the Foothills Fescue Subregion (Grassland Natural Region). Within this narrow band there is a gradient from the drier warmer prairies where aspen cover is rare, to the deciduous woodland-dominated areas in higher elevation areas to the west. The transition can occur across very short distances. Aspen woodland is rare east of Police Outpost Provincial Park yet becomes nearly continuous in the west part of Outpost Wetlands Natural Area, only 2 km to the west.

The flora of the study area is typical of parklands, characterized by a mosaic of grassland areas interspersed with groves of poplar woodland. Grassland covers most of the drier undulating and rolling till deposits, wheras the fluvial and lacustrine deposits adjacent to the lake, Outpost Wetland and intermittent drainage channels generally support shrublands or deciduous forest. Vegetation of similar aspen parkland to the south has been described in detail by Lynch (1955).

Forb-rich fescue grassland covers the drier gently rolling slopes, especially in the eastern part of the study area (Police Outpost Provincial Park). These grasslands are dominated by rough fescue (*Festuca campestris*) and are characterized by a wide diversity of forb species. Moss and Campbell (1947) note that fescue grasslands in the southwestern Alberta foothills are much richer in numbers of plant species than central Alberta fescue associations.

Shrubby cinquefoil (*Potentilla fruticosa)* is an important component of the fescue grasslands in the study area, possibly due to a history of grazing. Small patches of taller shrubs, such as choke cherry (*Prunus virginiana)* and saskatoon (*Amelanchier alnifolia)*, occur in locally rich deep soils within the grasslands, primarily on leeward or protected sides of small dips and swales.

In the Natural Area, there are only small remnants of native fescue grassland, mainly occurring on drier ridges or slopes where moisture levels are insufficient to support the growth of smooth brome (*Bromus inermis)*. The Natural Area experienced moderate to heavy levels of cattle grazing until the late 1980s. Rough fescue is a decreaser (Wroe et al. 1988), and prolonged grazing, prior to the area receiving protected status, has significantly reduced cover of fescue and other native plant species in this part of the study area. Significant invasion by smooth brome has occurred in much of the grasslands within the Natural Area.

Mixed aspen (*Populus tremuloides)* and balsam poplar (*P. balsamifera)* woods are found in cooler, moister, or protected parts of the study area. These deciduous woodlands occur on the moderately well to imperfectly drained soils adjacent to stream drainages, along the outer perimeter of ponds, and along the lake shoreline, as well as in higher elevation areas in the southwest part of the Natural Area. Balsam poplar is more common where soils are less well-drained, such as adjacent to the intermittent creek drainages.

Willow, primarily beaked willow *(Salix bebbiana)*, predominates in seepage areas and drainage depressions which are too wet to allow poplar growth. Beaked willow is a species that can withstand the changing soil moisture conditions such as occur along the perimeter of ponds and

lakes where water levels vary from year to year. Thus, bands of willow form a ring around the small ponds in the study area, and outline the poorly drained soils where intermittent creeks flow. The largest patches of willow occur on the damp soils south of the lake.

Outpost Wetland is one of the most extensive wetland communities in the region, supporting large expanses of large-leaved sedges, primarily water sedge *(Carex aquatilis)* and beaked sedge (*C. utriculata)*, swamp horsetail (*Equisetum fluviatile*), cattail (*Typha latifolia)*, and less commonly, common great bulrush (*Scirpus validus)*. Wetland vegetation also occurs in Outpost Lake and in the several small ponds in the study area. Floating and submerged vegetation, such as sago pondweed *(Potamogeton pectinatus)* and spiked water-milfoil (*Myriophyllum exalbescens)* are common in the deeper parts of the lake (Alberta Parks 1989), while water smartweed *(Polygonum amphibium)* is frequent closer to the shoreline and in more shallow water. Large patches of common great bulrush occur in some areas, especially along the shoreline northeast of the island, at the south end of the large bay just south of the picnic area and in the small bay at the south end of the lake. Common emergent vegetation in the ponds includes wire rush (*Juncus balticus)*, common great bulrush, and in one pond, cattail. Floating vegetation observed in these ponds includes common mare's tail *(Hippuris vulgaris)* and sago pondweed.

A recent plant checklist for Police Outpost Provincial Park and Outpost Natural Area includes over 400 species, a very diverse assemblage (Alberta Parks 1994). Several significant plant species have been recorded, including one, western blue flag (*Iris missouriensis*) of national significance. A list and discussion of the plant species of concern in the study area is provided below in Section 4.3.1.

2.8 Fauna: Overview

Deciduous forests, grasslands and wetlands provide feeding, hiding and breeding habitat for a diversity of fauna. Annotated lists of birds, mammals, amphibians, fish and butterflies observed in the study area are included in other documents (Crack and Danielson 1974, Alberta Parks 1989, Macdonald 1986). Since the current study recorded only incidental observations of fauna, the reader is referred to other documents for complete fauna species lists.

Bird life abounds in the area, and 107 species were recorded in a summary of bird observations to 1987 (Alberta Parks 1989). Many bird species nest in the study area, but it is also utilized as a resting place for migrating birds that nest elsewhere. Attractive species such as mountain bluebird (*Sialia currocoides)*, American goldfinch (*Spinus tristis)* and northern oriole (*Icterus galbula)* are not unusual, and birds more typical of northern wilderness areas, such as the common loon (*Gavia immer),* have visited.

Records of particular ornithological interest are confirmed nesting of sandhill cranes (*Grus canadensis)*, a species which more commonly nests in the north half of the province and farther north, and ring-necked ducks (*Aythya collaris*), which nest predominantly in north and central Alberta (Semenchuk 1992). Police Outpost Provincial Park supports a population of the smallest bird in Canada, the calliope hummingbird (*Stellula calliope*)(Alberta Parks 1989). Another species of note recorded in the study area is the black-headed grosbeak (*Pheucticus melanocephalus)*. Both of the latter two species are found in Alberta only in the southwest

corner of the province.

A total of 24 species of mammals have been recorded in the study area (Alberta Parks 1989). Of the large mammals, mule deer (*Odocoileus hemionus)* and white-tailed deer (*O. virginianus)* are fairly common, elk (*Cervus elaphus)* frequent an area northwest of the park and occasionally come into the park, and rarely, black bear (*Ursus americanus)*, cougar (*Felis concolor)* and bobcat (*Lynx rufus)* wander into the park.

Lists of fauna species recorded to date in the study area include two species, long-billed curlew (*Numenius americanus)* and Sprague's pipit (*Anthus spragueii)*, which are classed as Blue-listed in Alberta (Alberta Environmental Protection 1996). This status category includes species which are suspected of being at risk of extinction based on current knowledge. All blue-listed species may require management or further study of their populations and habitats (Alberta Environmental Protection 1996).

3.0 METHODS

3.1 Preliminary Interpretation

An initial examination of terrain features using 1:10 000 scale black and white aerial photographs (flown June 3, 1997, Job 97-120, Roll No. AS 4772) formed the basis of site selection. A brief literature review was also conducted to aid in planning the field work.

3.2 Field Data Collection

Field sampling took place June 16 to 21, 1997. Data was collected at 20 'complete' sites and 23 'reconnaissance' sites. At each of the complete sites, a releve (or plot), 10m X 10m for shrublands and grasslands, and 20m X 20m for forested areas, was established for collection of site, soil and vegetation data. Methods of data collection are outlined in the Ecological Land Survey Site Description Manual (Alberta Environmental Protection 1994). Detailed descriptions of the physical environment, and names and foliar cover of all plant species present were recorded. Photographs were taken at each site. An attempt was made to sample plots representative of the landscape unit.

At the reconnaissance sites, an abbreviated set of data was collected, including general descriptions of landform and soils, and a list of the most important vegetation species.

3.3 Ecological Land Classification and Mapping

The hierarchical structure of an Ecological Land Classification (ELC) is based on decreasing size and increasing homogeneity of units which are lower in the hierarchy (Rowe 1979). The landscape is divided into ELC units based on parameters such as landform, surficial materials, slope, dominant soils and vegetation.

Polygons were individually delineated on the map using aerial photograph interpretation supported by the site information collected during the field surveys. Although the results are presented at a 1:5000 scale, they are based on 1:10 000 aerial photography. Each polygon is identified with a number, and descriptions of the ecological conditions in each polygon are given in Appendix A. Physical land unit codes (for example M1 = gently undulating glacial till with well-drained, mesotrophic Orthic Black Chernozems) are defined in Appendix B, and vegetation codes (for example, dw1 = deciduous woodland dominated by aspen in the overstory and snowberry in the shrub layer) are defined in Appendix C. The field data collected at specific sites in 1997 allowed detailed descriptions of the vegetation within many of the individual polygons, but for areas not visited, a more general description of the predicted vegetation is given.

A digital database was constructed to correspond to polygons outlined on the map, listing the dominant landscape descriptive variables and vegetation for each polygon. The database was prepared to allow future GIS analysis and presentation if required. Map 1 polygon numbers were related to the following list of parameters: Landform and surficial materials, Soils, Ecological moisture regime, Nutrient regime, and Vegetation. Soil and parent materials classification codes

used in the database are from the Canadian System of Soil Classification (Canada Soil Survey 1987).

3.4 Vegetation Data Analysis (Plant Community Types)

Vegetation data were grouped by species composition according to the Braun-Blanquet tabular method described in Mueller-Dombois and Ellenberg (1974). This method involved sorting sample sites into groups or plant community types, according to similarities of species composition. The classification was then refined, which involved minor reorganization of the data based on site environmental characteristics such as landform and soil type.

Plant community types are named according to the dominant or representative plant species in one or more layers (for example, the aspen/snowberry community type has aspen predominating in the overstory tree layer, and snowberry in the shrub layer). Each community type is described in detail below, with average cover of typical species at sites examined. Plant taxonomy follows Moss (1983), with updates from Aiken and Darbyshire (1990) and Griffiths (1989). Common names are from the Alberta Plants Master Species List (Alberta Environmental Protection 1993).

3.5 Significant Natural Features

The evaluation of the significance of features or portions of the study area was based on a set of criteria outlined by Eagles (1984). Significant ecological features or areas were identified as those which satisfied any one or more of the following criteria:

1) performs a vital environmental, ecological or hydrological function
2) rare or unique geological or physiographic features or areas that contain them
3) significant rare or endangered plant or animal species or areas that support them
4) unique habitats that have limited representation in the region or are a small remnant of once large habitats which are now rare
5) contains an unusual diversity of plant and/or animal communities due to a variety of geomorphic features and microclimatic effects
6) contains large and relatively undisturbed habitats and provides sheltered habitat for species intolerant of human disturbance
7) provides an important linking function and permits the movement of wildlife over considerable distances, including migration corridors and migratory stopover points
8) representative, or a good example of that feature or ecosystem within the biogeographic area
9) widespread community interest or the presence of highly valued features or wildlife species.

The status of significant plant or animal species was based primarily on three sources: ANHIC (1996), COSEWIC (1996) and Alberta Environmental Protection (1996). Based on an evaluation of several factors, especially rarity and threats, these sources give flora or fauna species a designated status to aid in setting management priorities. A summary of the significant species of flora and fauna that occur in the study area is presented in Section 4.3.1 and 4.3.2, below.

Significant natural landscapes or areas supporting significant natural features such as rare flora or fauna are identified in Map 2. The specific locations and other details about significant rare plant populations are maintained in a provincial database (ANHIC - or Alberta Natural Heritage Information Centre), and data from this study were passed on to the relevant authorities for update of the database.

Information gathered during this study and from other research in Police Outpost Provincial Park or Outpost Wetland Natural Area was used to define broad Significant Landscapes. Each significant landscape has unique ecological parameters, which in turn support or maintain significant natural features such as rare plants that occur there. A summary of Significant Landscapes, and important natural features within each landscape, is given in Section 4.3.3.

4.0 RESULTS

4.1 Ecological Land Classification

Map 1 shows the study area delineated into ecological units. Appendix A, the polygon database, lists the physical land characteristics and predicted vegetation of each numbered polygon. Codes used for physical land characteristics and vegetation are given in Appendices B and C, respectively.

4.2 Plant Community Types

Sixteen different community types were defined in the study area, including deciduous woodlands, shrublands, native grasslands, disturbance communities, and wetlands. Plant communities develop in response to landform, surficial deposits, soils, and other site characteristics such as aspect and slope position. Factors related to the past history of land use (grazing intensity, cultivation) also strongly influence the vegetation.

The sampled plant community types are described below, grouped by major physiognomic type, with average cover values for typical species found in these communities. The vegetation mapping code used on Map 1 is given in brackets after the community type name. A list of scientific and common names for all species recorded in this study is given in Appendix D. Appendix E provides a comparison of community types found in the study area to other types described for similar areas in southwest Alberta.

4.2.1 Deciduous Woodland

In Police Outpost Provincial Park, aspen occurs in lower slope areas or depressions protected from the strong prevailing west winds. Deciduous forest predominates increasingly at higher elevations in the Outpost Wetlands Natural Area, due to associated cooler and moister conditions.

In the deciduous forest communities, aspen or balsam poplar, or both, form a closed canopy. Succession in the aspen and balsam poplar-dominated areas in much of the black soil zone, including Foothills Parkland, is theoretically to white spruce (*Picea glauca)* (Moss and Campbell 1947), but natural incidence of fire has prevented the succession. A few small spruce were found in an area of Police Outpost Provincial Park which had very deep rich black soils, and in higher elevation areas in the Outpost Wetlands Natural Area, southwest of the wetland.

Aspen/Snowberry (dw1)

This community type occurs where soil moisture and nutrient conditions are respectively mesic and permesotrophic. It was found on both Orthic Black Chernozems in the Park and on Orthic Dark Brown Chernozems in the southwest part of the Natural Area. This type is similar to the aspen / snowberry – saskatoon type of Willoughby et al.(1998).

A diverse forb layer is supported in the aspen / snowberry community type, dominated by species

such as veiny meadow rue (*Thalictrum venulosum),* yellow pea vine (*Lathyrus ochroleucus)* and blunt-fruited sweet cicely (*Osmorhiza chilensis).* The most common graminoids are Kentucky bluegrass (*Poa pratensis)* and smooth brome (*Bromus inermis)*, two non-native invaders. Due to a history of grazing, Kentucky bluegrass is well-established in much of the study area, especially in moister areas such as deciduous woodlands and mesic sections of grasslands (see Section 4.2.3 below, rough fescue – Kentucky bluegrass community type). Smooth brome is a tame forage species that was initially planted in a section of the Park that was previously cultivated under a haying lease dating back to 1939. The distribution of smooth brome appears to be expanding in the Park.

Community Type: Aspen/ snowberry	
Moisture regime: mesic	Nutrient regime: permesotrophic
Soil type: O.BL	Soil drainage: well
Parent materials: Till	Sites: 18, R16

Key and indicator species:			
Scientific name		Common name	Canopy cover (%)
Trees:	*Populus tremuloides*	Aspen	30
	Picea glauca	White spruce	1
Shrubs:	*Symphoricarpos occidentalis*	Snowberry	20
	Rosa woodsii	Common wild rose	10
	Amelanchier alnifolia	Saskatoon	4
Forbs:	*Thalictrum venulosum*	Veiny meadow rue	10
	Osmorhiza chilensis	Blunt-fruited sweet cicely	10
	Lathyrus ochroleucus	Yellow peavine	5
	Geum macrophyllum	Large-leaved yellow avens	3
	Actaea rubra	Red/white baneberry	5
	Sanicula marilandica	Snakeroot	1
	Geranium richardsonii	Wild white geranium	2
	Disporum trachycarpum	Fairy bells	2
Graminoids:	*Poa pratensis*	Kentucky bluegrass	20
	Bromus inermis	Smooth brome	10
	Phleum pratense	Timothy	2
	Poa interior	Inland bluegrass	1
	Agropyron trachycaulum	Slender bluegrass	5

Balsam poplar - Aspen / Willow / Cow parsnip (dw2)

This community type generally occurred in areas dissected by intermittent drainage channels, or where there was local seepage, a high ground water table and pockets of imperfectly drained soils. The overstory consisted of a mix of aspen and balsam poplar. Dead or dying poplars were

observed in several areas, particularly in the Park. Many of the poplar trees near the campground, for example, are estimated to be about 80 years old, and are likely simply dying of old age. This community type is similar to the balsam poplar / cow parsnip / Kentucky bluegrass type described in Willoughby et al.(1998).

Community Type: Balsam poplar - aspen / Willow / Cow parsnip	
Moisture regime: subhygric	Nutrient regime: permesotrophic
Soil type: O.BL	Soil drainage: moderately well to imperfectly
Parent materials: Till	Sites: 04 , R10

Key and indicator species:			
Scientific name		**Common name**	**Canopy cover (%)**
Trees:	*Populus tremuloides* *Populus balsamifera*	Aspen Balsam poplar	20 25
Shrubs:	*Salix bebbiana* *Cornus stolonifera* *Lonicera dioica* *Rosa acicularis* *Ribes inerme* *Symporicarpos albus*	Beaked willow Red-osier dogwood Twining honeysuckle Prickly rose Mountain gooseberry Snowberry	20 10 2 3 2 2
Forbs:	*Heracleum lanatum* *Senecio foetidus* *Actaea rubra* *Thalictrum venulosum* *Urtica dioica* *Osmorhiza depauperata* *Cirsium arvense* *Equisetum arvense* *Galium triflorum*	Cow parsnip Marsh butterweed Red/white baneberry Veiny meadow rue Common nettle Spreading sweet cicely Canada thistle Common horsetail Sweet-scented bedstraw	20 8 10 5 5 2 2 5 2
Graminoids:	*Poa pratensis* *Phleum pratense* *Bromus inermis*	Kentucky bluegrass Timothy Smooth brome	15 5 1

Aspen / Kentucky bluegrass - Smooth brome (dw3)

This community represents an aspen forest which has been impacted by grazing prior to the area receiving protected status. The creation of the protected areas has allowed some recovery of the community, as there are a few native forbs. However, these are found only in very low cover. The predominance of the non-native species, smooth brome and Kentucky bluegrass, likely prevents native species from thriving. Willoughby et al. (1998) describe a similar aspen / snowberry / Kentucky bluegrass community type.

Community Type: Aspen/Kentucky bluegrass - Smooth brome	
Moisture regime: mesic	Nutrient regime: Mesotrophic- permesotrophic
Soil type: O.BL	Soil drainage: well
Parent materials: Till	Sites: R3, R11, R17

Key and indicator species:			
Scientific name		**Common name**	**Canopy cover (%)**
Trees:	*Populus tremuloides* *Populus balsamifera*	Aspen Balsam poplar	35 5
Forbs:	*Aster ciliatus* *Hackelia jessicae* *Urtica dioica* *Taraxacum officinale* *Viola adunca* *Cerastium arvense* *Galium boreale* *Achillea millefolium* *Vicia americana*	Lindley's aster Jessica's stickseed Common nettle Common dandelion Early blue violet Field mouse-ear chickweed Northern bedstraw Common yarrow Wild vetch	2 4 4 5 1 1 1 1 1
Graminoids:	*Poa pratensis* *Bromus inermis* *Schizachne purpurascens*	Kentucky bluegrass Smooth brome Purple oat grass	25 30 5

4.2.2 Shrubland

Shrub communities include lowland willow, upland tall shrub, and prostrate shrub. They were primarily found at the edges of woodlands, or on sites with slightly greater moisture levels than surrounding areas, such as dips and swales and north-facing slopes with delayed snow melt or reduced evaporation, on lower receiving slopes, and in seepage areas.

Beaked willow/Baneberry (sh1)

The imperfectly drained willow shrublands in the study area were dominated by beaked willow (*Salix bebbiana)*. This species has a tolerance for a variety of moisture conditions, including wet soils, but cannot withstand long-term drought or inundation. The following community was developed on a Gleyed Rego-Black Chernozem, close to the channel of an intermittent creek flowing into Outpost Lake.

Beaked willow is a highly palatable browse species for wildlife. Willow community types should be recognized as important wildlife habitat.

Community Type: Beaked willow/Baneberry	
Moisture regime: Subhygric	Nutrient regime: Permesotrophic
Soil type: GLR.BL	Soil drainage: Imperfect
Parent materials: Fluvial veneer over till	Sites: 05

Key and indicator species:			
Scientific name		**Common name**	**Canopy cover (%)**
Shrubs:	*Salix bebbiana*	Beaked willow	45
	Cornus stolonifera	Red-osier dogwood	5
	Symphoricarpos albus	Snowberry	5
	Salix pseudomonticola	False mountain willow	1
Forbs:	*Actaea rubra*	Red/white baneberry	30
	Angelica arguta	White angelica	5
	Geranium richardsonii	Wild white geranium	5
	Equisetum arvense	Common horsetail	4
	Disporum trachycarpum	Fairy bells	3
	Heracleum lanatum	Cow parsnip	2
	Geum macrophyllum	Large-leaved yellow avens	2
Graminoids:	*Calamagrostis canadensis*	Bluejoint	20
	Phleum pratense	Timothy	15

Saskatoon - Common wild rose /Kentucky bluegrass - Rough fescue (sh2)

Patches of shrubs develop in the fescue grasslands where edaphic moisture conditions are favourable. Here they occur on sites with a mesic moisture regime and permesotrophic nutrient regime. The site examined represented a snow-lie area within the fescue grassland. Strong winds often redistribute snow, so that on the leeward slopes the snow cover is greater and lingers longer in spring-time.

This rich and diverse shrubland community type was generally found in distinct thickets. Soils at the shrub sites examined were very deep black chernozems. The most common shrub species in this community were saskatoon (*Amelanchier alnifolia)*, common wild rose (*Rosa woodsii)*, choke cherry (*Prunus virginiana)* and snowberry (*Symphoricarpos occidentalis)*. Jaques (1979) described a similar rough fescue-Parry oatgrass/ sticky purple geranium grassland which was physiognomically dominated by shrubs including prickly rose, snowberry and saskatoon (Appendix E).

Community Type: Saskatoon- Common wild rose / Kentucky bluegrass- Rough fescue	
Moisture regime: Mesic	Nutrient regime: Permesotrophic
Soil type: O.BL thick	Soil drainage: Well
Parent materials: Till; some colluvial	Sites: 15

Key and indicator species:

Scientific name		Common name	Canopy cover (%)
Shrubs:	*Amelanchier alnifolia*	Saskatoon	40
	Rosa woodsii	Common wild rose	10
	Prunus virginiana	Choke cherry	10
	Symphoricarpos occidentalis	Snowberry	5
Forbs:	*Monarda fistulosa*	Wild bergamot	5
	Hackelia jessicae	Jessica's stickseed	5
	Geranium viscosissimum	Sticky purple geranium	5
	Camassia quamash	Blue camas	2
	Epilobium angustifolium	Common fireweed	5
	Galium boreale	Northern bedstraw	4
Graminoids:	*Poa pratensis*	Kentucky bluegrass	25
	Festuca campestris	Rough fescue	20
	Agropyron dasystachyum	Northern wheat grass	3

Silverberry-dominated community type (sh3)

Small areas dominated by silverberry (*Elaeagnus commutata)* are scattered and uncommon in the study area. This tall shrub community is generally found in areas with dry coarse-textured soils. It occurs in small patches, such as on a south-facing ridge near one of the ponds in the southwest quarter, and in an area north of Outpost Lake. No site analysis was carried out within this type.

Creeping juniper/ Kentucky bluegrass - Timothy (sh4)

Although more common at dry sites, creeping juniper (*Juniperus horizontalis)* was also found in a rich, almost level area receiving slope wash from a ridge to the north. Here, juniper predominated, almost to the exclusion of all other species. This area had been altered by an invasion of two non-native species, Kentucky bluegrass and timothy (*Phleum pratense)*. The area showed evidence of previous cultivation, but it appeared that recovery to native vegetation was occurring. The climax community on this site is likely a rough fescue-dominated one.

Soils at these moist juniper-dominated sites showed evidence of recent seepage. Although there was no sign of gleying or mottling, the soils were saturated and there was apparently a perched water table, possibly because of the proximity of the underlying bedrock.

Community Type: Creeping juniper/ Kentucky bluegrass-Timothy	
Moisture regime: Subhygric	Nutrient regime: Permesotrophic
Soil type: GLCA.BL	Soil drainage: moderately well
Parent materials: Till (almost level)	Sites: 09

Key and indicator species:			
Scientific name		**Common name**	**Canopy cover (%)**
Shrubs:	*Juniperus horizontalis*	Creeping juniper	40
	Salix bebbiana	Beaked willow	2
	Potentilla fruticosa	Shrubby cinquefoil	2
Forbs:	*Galium boreale*	Northern bedstraw	2
	Potentilla gracilis	Graceful cinquefoil	1
	Vicia americana	Wild vetch	1
	Zizia aptera	Heart-leaved Alexanders	1
	Taraxacum officinale	Common dandelion	1
	Trifolium repens	White clover	1
Graminoids:	*Poa pratense*	Kentucky bluegrass	22
	Phleum pratense	Timothy	14
	Agropyron dasystachyum	Northern wheat grass	2

Creeping juniper - Common bearberry/ Rough fescue (sh5)

Prostrate shrubs such as creeping juniper and common bearberry (*Arctostaphylos uva-ursi)* are frequent in dry grassland communities on steep south-facing aspects, especially upper slopes and slope breaks, and hilltops, where soils are poorly developed or shallow to bedrock.

The creeping juniper - common bearberry/rough fescue community type was examined on a steep (38%) south-facing slope along a ridge north of Outpost Wetland. Creeping juniper and common bearberry usually prefer coarse-textured (such as sandy) or rocky areas. Another species indicative of the coarse textures at these sites was sand grass (*Calamovilfa longifolia)*. A wide diversity of xerophytic forbs and graminoids, well-adapted to the subxeric moisture conditions, were noted in this community type.

This community type is comparable to the rough fescue – sedge / bearberry type of Willoughby et al. (1998), and the creeping juniper phase of the rough fescue –Parry oatgrass-Idaho fescue type described by Jaques (1979), for study areas in the Montane natural subregion.

Community Type: Creeping juniper - Common bearberry / Rough fescue	
Moisture regime: Subxeric	Nutrient regime: Submesotrophic
Soil type: R.BL	Soil drainage: Rapid
Parent materials: Till veneer over bedrock; rock	Sites: 08

Key and indicator species:

	Scientific name	Common name	Canopy cover (%)
Shrubs:	*Juniperus horizontalis*	Creeping juniper	30
	Arctostaphylos uva-ursi	Common bearberry	31
Forbs:	*Heterotheca villosa*	Golden aster	1
	Antennaria parvifolia	Small-leaved everlasting	2
	Phlox alyssifolia	Blue phlox	1
	Phlox hoodii	Moss phlox	1
	Cryptantha nubigena	Clustered oreocarya	1
	Eriogonum flavum	Yellow umbrella-plant	1
	Penstemon nitidus	Smooth blue beard-tongue	1
	Hedysarum sulphurescens	Yellow hedysarum	1
	Artemisia frigida	Pasture sagewort	1
Graminoids:	*Festuca campestris*	Rough fescue	2
	Danthonia parryi	Parry oat grass	2
	Bouteloua gracilis	Blue grama	1
	Carex stenophylla	Low sedge	1
	Carex obtusata	Blunt sedge	2
	Calamovilfa longifolia	Sand grass	2

4.2.3 Native Grassland

Native grassland is the most extensive vegetation type in the study area. Grassland covers most of the drier undulating and rolling till deposits. Two fescue grassland types and one modified fescue grassland were identified in the study area. Their composition is governed by environmental conditions and extent of invasion by Kentucky bluegrass, a non-native species. Fescue grasslands are dominated by varying proportions of rough fescue, Idaho fescue (*Festuca idahoensis)*, and Parry oatgrass (*Danthonia parryi)*. In the modified fescue grasslands, Kentucky bluegrass is co-dominant with rough fescue.

A greater variety of forbs occurs in the foothills grasslands than in fescue grasslands in central Alberta (Moss and Campbell 1949). A number of species in the native grassland in the study area are distinct to southwestern Alberta.

Rough fescue - Parry oat grass - Idaho fescue (gr1)

This type grows where soil moisture and nutrient conditions are respectively mesic and mesotrophic. Shrubs are an important component of the native grassland vegetation, with scattered individual shrubby cinquefoil (*Potentilla fruticosa)* in grassland areas. There is also a highly diverse forb layer, and important forb species include sticky purple geranium (*Geranium viscosissimum)* and three-flowered avens (*Geum triflorum)*.

The rough fescue - Parry oat grass - Idaho fescue community type represents the climax or modal community type on undisturbed Black Chernozemic soils in the southwestern Alberta foothills grasslands (Willoughby et al. 1998). It was also described by Jaques (1979) in the Porcupine Hills and by Cornish (1997) in Upper Bob Creek Ecological Reserve.

Community Type: Rough fescue - Parry oat grass - Idaho fescue	
Moisture regime: mesic	Nutrient regime: Mesotrophic
Soil type: O.BL	Soil drainage: Well
Parent materials: Till; (minor amounts of glaciofluvial)	Sites: 06

Key and indicator species:			
	Scientific name	**Common name**	**Canopy cover (%)**
Shrubs:	*Potentilla fruticosa*	Shrubby cinquefoil	5
	Juniperus horizontalis	Creeping juniper	1
Forbs:	*Galium boreale*	Northern bedstraw	2
	Geum triflorum	Three-flowered avens	4
	Zygadenus venenosus	Death camas	2
	Antennaria anaphaloides	Tall everlasting	2
	Anemone patens	Prairie crocus	1
	Geranium viscosissimum	Sticky purple geranium	5
	Smilacina stellata	Star-flowered Solomon's seal	1
	Lupinus sericeus	Silky perennial lupine	1
	Hedysarum sulphurescens	Yellow hedysarum	1
	Penstemon confertus	Yellow beardtongue	1
	Monarda fistulosa	Wild bergamot	2
	Achillea millefolium	Common yarrow	2
	Vicia americana	Wild vetch	1
	Lithospermum ruderale	Woolly gromwell	1
	Sisyrinchium montanum	Common blue-eyed grass	1
	Heuchera parvifolia	Small-leaved alumroot	1
Graminoids:	*Festuca campestris*	Rough fescue	27
	Festuca idahoensis	Idaho fescue	23
	Danthonia parryi	Parry oat grass	14
	Bromus inermis	Smooth brome	3

Rough fescue - Kentucky bluegrass (gr2)

The rough fescue - Kentucky bluegrass community type represents a fescue grassland area that has been modified by invasion of the non-native species, Kentucky bluegrass. A similar Kentucky bluegrass – rough fescue community type was described by Willoughby et al.(1998).

Kentucky bluegrass is well-established in the study area and is co-dominant with rough fescue in most of the mesic grassland areas. Thus, the modal rough fescue - Idaho fescue - parry oat grass community is less extensive than the modified rough fescue-Kentucky bluegrass community.

It is interesting to note that the rough fescue-Kentucky bluegrass community in the study area is found only at sites with mesic soil moisture. The drier, nutrient-poor shallow soils on hilltops and steeper south-facing slopes apparently do not favour the establishment of Kentucky bluegrass.

Rough fescue is a decreaser; that is, cover values of this species decrease in response to grazing. Thus, heavy grazing pressure is known to reduce the competitive advantage of this species (Looman 1969, Moss and Campbell 1947, Wroe et al. 1988). Although grazing has not been permitted in the Provincial Park since the 1970s nor in the Natural Area since the late 1980s, historically these lands experienced moderate to heavy levels of grazing (Alberta Parks 1989). The impact of long-term grazing and predicted patterns of recovery are discussed in Willoughby et al. (1996). Complete protection of a site which has previously been grazed to the point of Kentucky bluegrass invasion allows rough fescue to recover, yet Kentucky bluegrass seems to remain as a codominant.

Community Type: Rough fescue - Kentucky bluegrass	
Moisture regime: Mesic	Nutrient regime: Mesotrophic to permesotrophic
Soil type: O.BL	Soil drainage: well
Parent materials: Till; minor amounts of Glaciofluvial	Sites: 03, 07, 17, R9, R12, R13a

Key and indicator species:			
	Scientific name	**Common name**	**Canopy Cover (%)**
Shrubs:	*Rosa woodsii*	Common wild rose	2
	Potentilla fruticosa	Shrubby cinquefoil	5
	Elaeagnus commutata	Silverberry	1
Forbs:	*Galium boreale*	Northern bedstraw	3
	Geum triflorum	Three-flowered avens	2
	Lupinus sericeus	Perennial lupine	2
	Achillea millefolium	Common yarrow	1
Graminoids:	*Festuca campestris*	Rough fescue	29
	Poa pratensis	Kentucky bluegrass	35
	Danthonia parryi	Parry oat grass	5
	Bromus inermis	Smooth brome	4

Idaho fescue - Parry oat grass - Rough fescue (gr3)

In drier grassland areas, such as hilltops and south-facing slopes, Idaho fescue (*Festuca idahoensis)* is the predominant grass species. This community type occurs on less well-developed soils, such as Rego-Black Chernozems, with a thin layer to bedrock. It is comparable to the Idaho fescue-Parry oatgrass-rough fescue community types described by Willoughby et al. (1998) and Cornish (1997), and the rough fecue – Parry oatgrass- Idaho fescue, Idaho fescue phase described by Jaques (1979).

In summer, the plants in these very exposed parts of the study area experience drying winds, high soil and air temperatures and high evaporation rates, conditions which early-maturing plants better survive (Looman 1982). Species in this community that are indicative of the hot and dry summer conditions and which flower early include Idaho fescue, moss phlox (*Phlox hoodii)* and blue phlox *(P. alyssifolia)*.

This community type is sensitive to physical disturbance. Many of the plants are slow-growing, mat-forming species with shallow roots, and soils are thin and dry.

Community Type: Idaho fescue - Parry oat grass - Rough fescue	
Moisture regime: Submesic	Nutrient regime: mesotrophic
Soil type: R.BL	Soil drainage: rapid to well
Parent materials: Till veneer over bedrock; rock	Sites: 01, 16 , R7, R13b,R14

Key and indicator species:			
Scientific name		**Common name**	**Canopy cover (%)**
Shrubs:	*Potentilla fruticosa*	Shrubby cinquefoil	2
Forbs:	*Anemone patens*	Prairie crocus	2
	Selaginella densa	Prairie selaginella	1
	Phlox alyssifolia	Blue phlox	1
	Phlox hoodii	Moss phlox	3
	Paronychia sessiliflora	Low whitlow-wort	1
	Zygadenus elegans	White camas	1
	Heterotheca villosa	Golden aster	4
	Oxytropis sericea	Early yellow locoweed	1
Graminoids:	*Festuca idahoensis*	Idaho fescue	28
	Danthonia parryi	Parry oat grass	22
	Festuca campestris	Rough fescue	11
	Koeleria macrantha	June grass	4
	Carex stenophylla	Low sedge	1

4.2.4 Disturbance Community Types

Tame forage; hayfields, lawns (cd1, cd2)

The areas on Map 1 outlined as cultivated- disturbed (cd1, cd2) were seeded to tame grass species. About 24 ha of grassland in the southeast quarter of the provincial park were cultivated under a haying lease first issued in 1939. The land was replanted to smooth brome and timothy within the last 25 years (Alberta Parks 1989). A permit to mow and remove hay was last issued in 1986. In some previously mowed areas, native forbs are beginning to regenerate.

Park facility areas also represent disturbance communities. Facility areas were planted to domestic (lawn) grass species for park management purposes.

Associations of tame forage species in the study area included Kentucky bluegrass - timothy, timothy - smooth brome, Kentucky bluegrass - smooth brome, and Kentucky bluegrass - creeping red fescue (all classed as cd1), and forbs/smooth brome - timothy- Kentucky bluegrass (cd2). Since species composition at these sites was assumed to be primarily dependent on the seeding mixture rather than on environmental conditions, cover values of species on cultivated/disturbed sites were not recorded. The most common forage species found during this study are listed below. Soils were Orthic Black Chernozems developed on flat to gently undulating till. Fescue grassland would be the expected climax vegetation on these sites if no disturbance had occurred.

Community Type: Tame forage; hayfields; lawns;	
Moisture regime: Mesic	Nutrient regime: Mesotrophic to permesotrophic
Soil type: O.BL	Soil drainage: Well
Parent materials: nearly level till	Sites: R4, R15

Key and indicator species:			
Scientific name		Common name	Canopy cover (%)
Graminoids:	*Phleum pratense*	Timothy	-
	Bromus inermis	Smooth brome	-
	Poa pratensis	Kentucky bluegrass	-
	Festuca rubra	Creeping red fescue	-

Non-native species have invaded other areas of the study area as well, especially areas adjacent to trails. Smooth brome, Kentucky bluegrass and timothy are all well-established in the study area, most commonly in moister grassland areas, and in the deciduous forests. Smooth brome is extensive in historically grazed or cultivated areas in Outpost Wetland Natural Area, and has invaded disturbed areas adjacent to a new hiking trail recently constructed in the southwest quarter of the Provincial Park. The areal extent of this species appears to be expanding in both the Park and the Natural Area, especially in the moister dips and swales.

Several plant species classed as noxious or nuisance weeds (Alberta Weed Control Act, amended 1991) have been recorded in the study area. They are listed below, along with a brief description of recorded locations.

a) Noxious weeds – defined as plants that are detrimental to land use or to the general environment, but are now so widespread that eradication is not practicable:
- -perennial sow thistle (*Sonchus arvensis*)
    - - primarily along roadsides
- -Canada thistle (*Cirsium arvense*)
    - - primarily in previously disturbed areas such as along roadsides, trails, disturbed shorelines and near the old dump site northeast of the administration area;
    - -extensive infestation on the island in Outpost Lake;
    - - control of this species is difficult because of its rhizomatous habit and its associated ability to regenerate from even a small piece of live root.
- -toadflax (*Linaria vulgaris)*
    - - occurs just south of the study area, in Montana (Alberta Parks 1989); expected in the study area.

b) Nuisance weeds - these are plants which are common and widespread but do not pose a high degree of threat to land use. In the study area, these weeds were most common along roadsides, especially along the road to the study area.
- - downy brome (*Bromus tectorum)*
    - - at a regional or local management level, this species may be considered more serious than a nuisance weed (H.Gerling, Alberta Agric., pers. comm.);
    - - this species is a winter annual;
- - flixweed (*Descurainia sophia)*
- - shepherd's purse (*Capsella bursa-pastoris)*
- - wild buckwheat (*Polygonum convolvulus)*
- - dandelion (*Taraxacum officianale)*

4.2.5 Wetlands

There are several wetland communities occurring in the study area, associated with intermittent drainages, small depressions, and the major waterbodies of Outpost Lake and Outpost Wetland. These wet lowlands are eutrophic to hypereutrophic, and moisture conditions vary from subhydric to hydric.

In addition, moisture conditions in the wetlands will vary from season to season and between years, depending on precipitation levels. An examination of air photos from 1986 and 1997 shows that water levels in Outpost Wetland in 1997 were significantly higher than in 1986. Also, several discontinuous patches of willows occupying shallow 'islands' within the wetland are now dead. The death of the willows likely indicates prolonged flooding.

A wide variety of plant communities are found in Outpost Wetland. Willows occur in a band

along the edges of the wetland. Shallower areas of the inundated wetland are occupied by sedges, primarily water sedge (*Carex aquatilis)* and beaked sedge (*C. utriculata).* Deeper parts of the wetland support well-developed zones of emergent vegetation, especially cattail (*Typha latifolia)* and swamp horsetails (*Equisetum fluviatile)*, with small patches of willow/beaked sedge. A narrow zone of emergent bulrush, cattail and sedges also occurs around most of the shoreline of Outpost Lake. Emergent aquatic vegetation provides feeding, hiding and nesting habitat for waterbirds, such as red-necked grebes (*Podiceps grisegena)*, bitterns (*Botaurus lentiginosus)*, great blue herons (*Ardea herodias),* sora rails (*Porzana carolina)* and ducks.

Several floating and submerged aquatic plant species have been recorded in the lake during this and other studies. However, no estimation of the relative predominance of each species was carried out. Submerged species include spiked water-milfoil (*Myriophyllum exalbescens)*, clasping-leaved pondweed (*Potamogeton richardsonii)* and sago pondweed (*Potamogeton pectinatus).* Sago pondweed is a highly desirable species for waterfowl. These aquatic communities greatly increase substrate habitat for invertebrates which are food organisms for many bird and fish species and thus are important in the food chain.

Wetland meadow – (Fowl bluegrass – wire rush) (wt1)

This community type is typical of the poorly drained perimeter of wetlands and other areas subject to periodic flooding. Soils are most commonly Orthic Humic Gleysols on lacustrine parent materials. Soil moisture regimes at these sites are generally subhydric, with less standing water than in the sedge wetland and other aquatic emergents community types. In this community, graminoids, especially fowl bluegrass (*Poa palustris)* and wire rush (*Juncus balticus)*, predominate, and a wide diversity of forbs can be found. Shrubs such as willows and water birch (*Betula occidentalis)* occur as scattered individuals primarily at the drier edges of these wetland meadows, and survive as long as soils are not completely saturated for the entire year. This community type represents a transition from upland willow/forb to the more permanently inundated sedge wetlands.

Community Type: Wetland meadow (fowl bluegrass – wire rush)	
Moisture regime: subhydric	Nutrient regime: eutrophic
Soil type: R.HG, O.HG	Soil drainage: poorly
Parent materials: Lacustrine	Sites: 10b, 21, R1

Key and indicator species:			
Scientific name		**Common name**	**Canopy cover (%)**
Forbs:	*Triglochin maritima*	Seaside arrow-grass	4
	Potentilla anserina	Silverweed	4
	Equisetum laevigatum	Smooth scouring-rush	5
	Equisetum fluviatile	Swamp horsetail	2

	Viola nephrophylla	Bog violet	1
	Sium suave	Water parsnip	1
	Allium schoenoprasum	Wild chives	5
	Rumex occidentalis	Western dock	1
Graminoids:	*Poa palustris*	Fowl bluegrass	20
	Juncus balticus	Wire rush	15
	Calamagrostis inexpansa	Northern reed grass	2
	Hierochloe odorata	Sweet grass	1
	Deschampsia cespitosa	Tufted hair grass	2
	Puccinellia nuttalliana	Nuttall's salt-meadow grass	2
Shrubs:	*Salix discolor*	Pussy willow	4
	Salix bebbiana	Beaked willow	5
	Betula occidentalis	Water birch	2

Tufted hair grass - Nuttall's salt-meadow grass (slightly saline wet meadow) (wt2)

Due to intermittent flooding and drying out, some moist meadows in the study area show a limited amount of alkalinity, although no true solonetzic soils were found. In these slightly saline grassy meadows, halophytic species such as gumweed (*Grindelia squarrosa)* and nuttall's salt-meadow grass (*Puccinellia nuttalliana)* were found. One rare plant species, one-flowered iron-plant (*Haplopappus uniflorus*), preferred this habitat. Soils in this community type were hypereutrophic Orthic Humic Regosols.

Community Type: Tufted hair grass – Nuttall's salt-meadow grass	
Moisture regime: Hygric	Nutrient regime: Hypereutrophic
Soil type: O.HR	Soil drainage: poorly
Parent materials: Lacustrine	Sites: R6, 11

Key and indicator species:			
Scientific name		**Common name**	**Canopy cover (%)**
Forbs:	*Haplopappus uniflorus*	One-flowered iron-plant	5
	Dodecatheon pulchellum	Saline shooting star	2
	Grindelia squarrosa	Gumweed	5
	Allium textile	Prairie onion	1
	Achillea millefolium	Common yarrow	1
Graminoids:	*Deschampsia cespitosa*	Tufted hair grass	30
	Puccinellia nuttalliana	Nuttall's salt-meadow grass	25
	Agrostis scabra	Rough hair grass	5
	Juncus balticus	Wire rush	1
	Carex bebbii	Bebb's sedge	2
	Distichlis stricta	Desert salt grass	2
	Calamagrostis inexpansa	Northern reed grass	1

Willow/beaked sedge (wt3)

This community was most commonly found as a narrow fringe along both sides of Outpost Wetland, as well as in small pockets within the wetland itself. The wetland receives nutrient enrichment from the surrounding areas through surface runoff, as well as from flowing Boundary Creek. Compared to the beaked willow/ baneberry community, the willow/beaked sedge community is found to grow on much wetter soils, where the water table is at or above the surface. However, in some areas, such as south of Outpost Lake, there may be a continuum between the two willow-dominated communities along a soil moisture gradient.

The most common or dominant willow species in the willow/beaked sedge community were velvet-fruited willow (*Salix maccalliana)* and beaked willow. Dense clumps of willows, with minimal graminoid cover, are interspersed with open areas where beaked sedges form a continuous and dense cover.

Community Type: Willow/beaked sedge	
Moisture regime: subhydric to hydric	Nutrient regime: eutrophic
Soil type: R.HG	Soil drainage: poorly to very poorly
Parent materials: Lacustrine; lacustrine over glaciofluvial	Sites: #19

Key and indicator species:			
Scientific name		**Common name**	**Canopy cover (%)**
Shrubs:	*Salix maccalliana*	Velvet-fruited willow	50
	Salix bebbiana	Beaked willow	10
	Salix myrtillifolia	Myrtle-leaved willow	5
	Salix exigua	Sandbar willow	2
	Betula occidentalis	Water birch	2
Forbs:	*Equisetum palustre*	Marsh horsetail	5
	Geum aleppicum	Yellow avens	4
	Geum rivale	Purple avens	5
	Allium schoenoprasum	Wild chives	3
	Valerian dioica	Northern valerian	2
Graminoids:	*Carex utriculata*	Beaked sedge	65
	Juncus balticus	Wire rush	3
Mosses:	*Tomenthypnum nitens*	Golden moss	5

Sedge wetland (Water sedge – beaked sedge) (wt4)

Soils in the sedge-dominated wetlands were typically Rego Gleysols and Humic Regosols. The continuous inundation of these areas restricts community composition to those plant species tolerant of the wet conditions, and the first species to become established in water-filled depressions are often sedges. The most common sedges in this wetland community were the broad-leaved species, water sedge and beaked sedge. Beaked sedge is indicative of a nitrogen-rich environment, whereas a high cover of water sedge indicates calcium-rich stagnant water (Brierley et al. 1985; Willoughby et al. 1996). Floating-leaved aquatic plant species were also noted in this community.

Community Type: Sedge wetland (water sedge – beaked sedge)	
Moisture regime: hydric	Nutrient regime: Eutrophic
Soil type: R.G, H.R.	Soil drainage: Very poorly
Parent materials: Lacustrine; lacustrine over glaciofluvial	Sites: 20, R8

Key and indicator species:			
	Scientific name	**Common name**	**Canopy cover (%)**
Shrubs:	*none*		
Forbs:	*Hippuris vulgaris*	Common mare's-tail	1
	Ranunculus circinatus	Firm white water crowfoot	1
	Polygonum amphibium	Water smartweed	1
Graminoids:	*Carex aquatilis*	Water sedge	70
	Carex utriculata	Beaked sedge	25
	Carex lanuginosa	Woolly sedge	5
	Juncus balticus	Wire rush	3

Deep water emergents (wt5)

It was not possible to intensively sample these community types because of the water depth. However, extensive stands dominated by swamp horsetail, common great bulrush, sedges or cattail occur within Outpost Wetlands. Also, patches of aquatic emergents, primarily cattail and common great bulrush, occur in the shallower waters along the shoreline of Outpost Lake.

4.3 Significant Natural Features

4.3.1 Significant Flora

At least 12 significant plant species have been recorded in Police Outpost Provincial Park or Outpost Wetlands Natural Area in this study or by previous workers (Table 1). Details of their status, habitat requirements and occurrence are given below.

The primary source used to determine the status of plant species found in the study area was the Alberta Natural Heritage Information Centre (ANHIC 1996). The ANHIC database identifies species of special concern, and ranks their priority. Species are ranked based primarily on number of occurrences, with consideration also given to distribution and current threats to populations. These ranking classes (e.g. S1, S2) are summarized in Appendix F. Rare plant species of highest management priority are those included in the Tracking List (Table 1), followed by those on the Watch List.

Many of the species included in Table 1 are restricted to southwest part of the province (Moss 1983). Further information on the distribution of these species is provided in Wallis et al. (1986) and (1987), and Fairbarns et al. (1987).

The significant plant species in the study area are listed below, with SRANK as per ANHIC (1996):

1) *Angelica dawsonii* S. Watts (Yellow angelica)
Status: On Alberta Watch List; ranked S3; restricted southwest Alberta range, but not uncommon (Wallis et al. 1986);
Habitat: moist meadows and woods along streams; flowers late June
Occurrence: recorded by Wallis (1989); and this study (1997)

2) *Bromus vulgaris* (Hook.) Shear (Mountain brome)
Status: On Alberta Watch List; ranked S3 ; southwest Alberta distribution in Montane and Foothills Parkland habitats up to Crowsnest Pass area (Wallis et al. 1986)
Habitat: Moist meadows and open woodlands at lower and middle elevations
Occurrence: found this study (1997) in open aspen woods, and by Wallis (1989)

3) *Bupleurum americanum* Coult. & Rose (Through-wax)
Status: S3 on Alberta Watch List ; restricted to southwest Alberta (Moss 1983)
Habitat: dry hillsides
Occurrence: recorded by Wallis (1989), and this study

4) *Camassia quamash* (Pursh) Greene *var. quamash* (Blue camas)
Status: S2 on Alberta Tracking List; found only in the southwest part of the province; moderately threatened due to habitat loss (ANHIC 1996)
Habitat: wet meadows
Occurrence: several records in the study area (ANHIC database, 1996); also this study (1997)

Table 1. Significant plant species recorded at Police Outpost Provincial Park and Outpost Wetlands Natural Area, based on ANHIC (1996). Definitions of Ranking Codes are given in Appendix E.

Species	Common name	Ranking Code (ANHIC (1996)
Tracking List [a] :		
Camassia quamash var quamash	Blue camas	S2
Carex raynoldsii	Raynold's sedge	S2
Castilleja cusickii	Yellow paintbrush	S2
Conimitella williamsii	Conimitella	S2
Iris missouriensis	Western blue flag	S1S2
Melica smithii	Melic grass	S2
Melica subulata	Alaska onion grass	S2
Prenanthes sagittata	Purple rattlesnakeroot	S2
Watch list[b]:		
Angelica dawsonii	Yellow angelica	S3
Bromus vulgaris	Woodland brome	S3
Bupleurum americanum	Through-wax	S3
Haplopappus uniflorus	One-flowered ironplant	S3

[a] Alberta Natural Heritage Information Centre (1996): Alberta Tracking List: highest priority plant species;

[b] Ibid. Alberta Watch List: species which require further information.

5) *Carex raynoldsii* Dewey (Raynold's sedge)
Status: S2 on Alberta Tracking List ; found only in southwest Alberta and the Cypress Hills (Moss 1983);
Habitat: moist, open or wooded slopes (Moss 1983); moist grassland
Occurrence: recorded in this study (1997); also Crack and Danielson (1974) in moist grassland

6) *Castilleja cusickii* Greenm. (Yellow paintbrush)
Status: ranked S2 on ANHIC tracking list; rare in Alberta (Packer and Bradley 1984); recommended classification as 'endangered' (Wallis et al. 1986);
Habitat: moist meadows and grassland
Occurrence: recorded by Wallis et al. (1986) in Police Outpost Prov. Park (only 1 or 2 individual plants) and Wallis (1989) in Outpost Wetland Natural Area, where only 3 plants were found in moist grassland along north boundary of the Natural Area. In 1997, the area referred to in Wallis (1989) had been invaded by introduced grasses (primarily smooth brome), and no yellow paintbrush were found; this population has apparently disappeared.

7) *Conimitella williamsii* (D.C. Eat.) Rydb. (Conimitella)
Status: S2 on ANHIC Tracking List; only 6-20 records (ANHIC 1996)
Habitat: open montane, grassland slopes
Occurrence: recorded by Wallis (1989) and this study

8) *Haplopappus uniflorus* (Hook.) T. & G. (One-flowered ironplant)
Status: S3, on ANHIC Watch List ; appears to be a unique population in Canada, representing a northern outlier of a southern population of this species which ranges from California to Montana (Alberta Parks 1989)
Habitat: exposed clay soils, slightly alkaline areas with subsurface moisture
Occurrence: recorded by Wallis et al. (1986), and in this study (1997)

9) *Iris missouriensis* Nutt. (Western blue flag)
Status: S1S2 on Alberta Tracking List; high priority for conservation because it is designated threatened in Canada (COSEWIC 1996); potentially endangered in Alberta. Distribution of native populations in Alberta at only a few sites near the international border, represents the northern edge of its North American range. The *Iris* population in the study area was monitored in 1987 (Wallis 1988); the current viability of the population needs to be formally re-examined.
Habitat: moist meadows that are wet in early spring are often dry later in the summer
Occurrence: recorded in ANHIC database; also 1997

10) *Melica smithii* (Porter) Vasey (Melic grass)
Status: S2 on Alberta Tracking List ;
Habitat: moist deciduous woodland

Occurrence: recorded by Wallis (1989) - one small stand of 50 plants;

11) *Melica subulata* (Griseb.) Scribn. (Alaska onion grass)
Status: S2 on Alberta Tracking List ;
Habitat: moist deciduous woodland
Occurrence: recorded by Wallis (1989); and this study

12) *Prenanthes sagittata* (A. Gray) A. Nels. (Purple rattlesnakeroot)
Status: S2 on Alberta Tracking List ; very limited distribution in Canada, in extreme southwest Alberta only (Argus and Pryor 1990)
Habitat: moist woods and thickets
Occurrence: recorded in the Park by Shaw (1977).

4.3.2 Significant Fauna

Within the faunal assemblage of the study area are several species which are of special management concern. Table 2 presents a list of significant faunal species recorded in the study area, their status and occurrence at Police Outpost Provincial Park or Outpost Wetlands Natural Area. Appendix G lists the evaluation systems used to determine status of the species listed.

Table 2. Significant faunal species recorded at Police Outpost Provincial Park and Outpost Wetlands Natural Area. Definitions of status categories are given in Appendices F and G.

Common Name	**Latin Name**	**Status**	**Study Area Records (1987, 1997)**
BIRDS: Pied-billed grebe	*Podilymbus podiceps*	Yellow A-listed	observed on pond (1987)
Red-necked grebe	*Podiceps grisegena*	Yellow A-listed	nests at Outpost Lake
American white pelican	*Pelecanus eythrorhynchos*	Yellow B-listed	occasional visitor
American bittern	*Botaurus lentiginosus*	Yellow A-listed	uncommon resident;
Osprey	*Pandion haliaetus*	Yellow B-listed	occasional visitor
Swainson's hawk	*Buteo swainsonii*	Yellow A-listed	occasional
Prairie falcon	*Falco mexicanus*	Yellow A-listed; S3 (ANHIC 1996)	occasional
Sharp-tailed grouse	*Typanuchus phasianellus*	Yellow A-listed	occasional
Sandhill crane	*Grus canadensis*	Yellow B-listed; S3 (ANHIC 1996)	occasional resident; nests in Outpost Wetlands
Long-billed curlew	*Numenius americanus*	Blue-listed	occasional resident
Black tern	*Chlidonias niger*	Yellow A-listed	fairly common resident;
Black-billed cuckoo	*Coccyzus erythropthalmus*	Status Undetermined	recorded 1987
Calliope hummingbird	*Stellula calliope*	S3 (ANHIC 1996)	occasional resident
Marsh wren	*Cistothorus palustris*	Yellow B-listed	occasional in Outpost Wetlands
Sprague's pipit	*Anthus spragueii*	Blue-listed in Alberta	occasional resident in grasslands
Western meadowlark	*Sturnella neglecta*	Yellow A-listed	occasional resident in grasslands
Clay-coloured sparrow	*Spizella pallida*	Yellow A-listed	occasional at habitat edges
MAMMALS: Badger	*Taxidea taxus*	Yellow A-listed	occasional
Long-tailed weasel	*Mustela frenata*	Yellow A-listed	rare resident
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	Yellow A-listed	rare resident
Richardson's ground squirrel	*Spermophilus richardsonii*	Yellow A-listed	occasional resident
Bobcat	*Lynx rufus*	Yellow B-listed	very rare visitor

4.3.3 Significant Landscape Features

Significant landscape features or habitat areas are shown on Map 2. The entire study area has been rated as nationally significant, because it supports one of three naturally occurring populations of western blue flag in Canada, and because ungrazed moist foothills grassland is rare in Canada (Cottonwood Consultants 1987). However, within different portions of the study area, the resource values vary. The characteristics of each t area are summarized below.

A) Rich fescue grasslands
- uncultivated native forb-rich fescue grassland; few of these still remain uncultivated in the Foothills Parkland (Cottonwood Consultants 1987)
- a reservoir for several plant species which are rare or uncommon in Alberta and Canada,
- because the area is in an ecological transition zone, there are many plant species that are at the limit of their range, or are restricted to a small area
- supports native grassland bird fauna including species which are declining as their habitat disappears to cultivation - for example, sharp-tailed grouse (*Tympanuchus phasianellus),* and Sprague's pipit (*Anthus spragueii).*

B) Xeric ridgetop grasslands
- exposed slopes support wide diversity of xerophytic species including several rare plant or uncommon species
- supports native grassland bird fauna similar to fescue grasslands.

C) Outpost Wetland
- a diverse complex of willow thickets, sedge meadows; and emergent vegetation
- this is one of the most productive breeding bird habitats in the region, and supports many birds which are restricted to wetland habitats, such as sora rail (*Porzana carolina),* common snipe (*Gallinago gallinago),* American bittern (*Botaurus lentiginosus),* northern waterthrush (*Seiurus noveboracensis),* marsh wren (*Cistothorus palustris),* many more;
- hydrological significance: maintenance of water table in periods of low precipitation.

D) Poplar woodland
- diverse vegetation, supports several significant plant species such as woodland brome (*Bromus vulgaris),* and Alaska onion grass (*Melica subulata)*
- provides important year-round habitat for deer; also provides habitat for species such as yellow pine chipmunk (*Tamias amoenus)* and veery (*Catharus fuscescens)*
- standing dead aspen provide important habitat for cavity-nesting birds.

E) Ponds, lake, wet meadows, and minor wetland areas
- nesting and feeding habitat for many animals, including significant species (e.g. pied-billed grebe, marsh wren and long-tailed weasel), as well as many others of interest such as common loons, belted kingfisher (*Ceryle alcyon),* wilson's phalarope (*Phalaropus tricolor),* osprey (*Pandion haliaetus),* and beaver (*Castor canadensis)*
- shorelines and wet meadows support rare plants, such as western blue flag.

5.0 DISCUSSION

The study area, representing Police Outpost Provincial Park and Outpost Wetlands Natural Area, has been classed as nationally significant (Cottonwood Consultants 1987). The presence of numerous rare plants, the productive habitats supporting a diversity of flora and fauna, and the inclusion of ungrazed foothills grassland are factors that support the national significance rating.

Few sizeable undisturbed areas of Foothills Parkland remain in Canada, since much of the original vegetation has been impacted by grazing or cultivation (Cottonwood Consultants 1987). Police Outpost Provincial Park and Outpost Wetlands Natural Area represent one of the few Foothills Parkland areas officially protected. The Foothills Parkland consists of a narrow transition zone between the Montane and the Foothills Grasslands regions.

The study area supports a diverse assemblage of plant and animal species. Because it is in an ecological transition zone, many plant and animal species found there are at the limit of their range. That is, elements of both the adjacent natural subregions, the Montane and the Foothills Grassland, occur in the study area. In addition, a large number of significant species have been found in the study area, including eight plant species on the 1996 ANHIC Tracking List, and four plant species on the Watch List (ANHIC 1996). One species found in the Park, western blue flag, is found at only a handful of sites in Canada and is designated threatened nationally (COSEWIC 1996). Western blue flag has the highest priority for species protection within the study area, and managers should ensure protection of this species where it is found.

Fauna species considered of special management concern include two blue-listed species (may be at risk), Sprague's pipit and long-billed curlew (Alberta Environ. Protection 1996). Managers should be aware of species habitat needs to allow effective management for their protection.

Also included in the study area is Outpost Wetland, which is one of the largest wetlands in the region (Cottonwood Consultants 1987) and supports a diverse population of breeding birds. In addition, this wetland likely plays a hydrological role in maintenance of regional water tables in periods of low precipitation, and should be protected from disturbance to natural flow patterns.

The Provincial Park supports an area of remnant fescue grassland which has been protected from grazing since 1970. However, intensive grazing occurred until recently in the Natural Area. Kentucky bluegrass and smooth brome, two non-native grass species, are well-established in the moister areas of the study area, especially the Natural Area. The areal extent of smooth brome appears to be spreading, in the southwest quarter of the Park adjacent to a new hiking trail, and to an even greater degree in the Natural Area, where this species dominates in most of the mesic grassland areas. It is recommended that measures to control this species be investigated. Attempts should be made to slow the spread of the species. Soil disturbance should be avoided.

As the status of flora and fauna species is continually updated, periodic inventory of the plant and animal assemblages in the Park is recommended. New species of concern may be located, or species status may change to the extent that management priority is altered. Park managers should be aware of the locations of significant features, in order to allow effective protection.

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APPENDIX A. Map 1 database, Police Outpost study area.

POLYGON	PM*1	PM2	SOIL1	SOIL2	MOIST.	NUTR.	VEG1	VEG2
1	M2	F1	O.BL		4	4	dw1	
2	M2		O.BL		4	4	cd1	
3	M1		O.BL		4	3	cd1	
4	M2	F1	O.BL		4	4	dw1	
5	F1	L1	O.HG		5	4	cd2	
6	M1		O.BL		4	3	cd2	
7	M2		O.BL		5	4	dw3	
8	M2	L2	O.BL		5	4	dw2	
9	L2		O.HG		7	5	wt1	sh1
10	L2		O.HG		7	5	sh1	
11	L2	M2	GL.BL		6	4	dw2	
12	L1		O.HR	GLR.BL	7	6	wt2	
14	M2	L2	O.BL		5	4	dw2	
15	F1		OLHG		5	4	dw2	
16	F1	L1	OLHR	GLR.BL	7	6	wt2	
17	M3		O.BL		3	3	gr3	
18	M1		O.HG		4	3	gr2	
19	L2		O.HR		8	4	wt3	wt5
20	L1		O.HR		7	7	wt2	
21	L2	MGF1	O.HG	O.BL	4	3	sh2	sh3
22	M1		O.BL		4	3	gr2	
23	M2		O.BL		4	4	cd1	
24	M2		GLCA.BL		5	4	cd2	
25	M2	F1	O.BL	GLCA.BL	5	4	sh1	
26	M2	F1	O.BL	GLCA.BL	5	4	dw2	
27	M2		O.BL		4	4	cd1	
30	M2	F1	O.BL		5	4	dw2	
31	MC1		O.BL		4	4	gr2	
32	MC1		O.BL		4	4	sh2	
33	M1		O.BL		4	3	gr2	
34	M1		O.BL		4	4	cd1	
35	M1		O.BL		4	3	gr2	
36	M1		O.BL		4	3	sh4	
37	MX1		R.BL	O.BL	2	2	sh5	
38	M1		O.BL		4	3	cd1	
39	M1		O.BL		4	3	gr1	
40	F1	M1	O.BL		4	4	gr2	
41	GF1		O.BL		4	3	gr	
42	L3		R.HG	R.G	8	5	wt3	
43	L3		R.HG		8	5	wt3-4	
44	L3		R.HG		8	5	wt4	wt3
45	L3		R.HG	TH.F	8	5	wt3	
46	GF1		O.BL		4	3	sh2	cd2

POLYGON	PM*1	PM2	SOIL1	SOIL2	MOIST.	NUTR.	VEG1	VEG2
47	L3		R.HG		8	5	wt3	
48	L2	GF2	O.HG	GL.BL	6	4	wt1	
49	GF2		O.BL		4	4	cd1	
50	M1		O.BL		4	3	gr1	
51	L2		O.HG		7	5	wt1	
52	GF1		O.DB		3	3	gr3	
53	L3		R.HG		8	5	wt4	
54	GF1		O.DB		3	3	gr3	
55	L3		R.HG		8	5	wt5a	
56	L3		R.HG		8	5	wt5b	
57	GF1		O.BL		4	3	gr	
58	MGF1		O.DB		4	4	dw1	
59	F1		O.BL		5	4	dw2	
60	GF1		O.BL		4	4	dw1	cd1
61	GF1		O.BL		4	4	cd1	
62	GF1		O.BL		4	4	dw1	
63	MGF1		O.DB		4	4	dw1	
64	MGF1		O.DB	O.DB, thin	4	3	gr3	gr2
65	F1		O.DB		5	4	sh1	
66	MGF1		O.DB	O.BL	4	4	dw1	
67	GF1		O.BL		4	4	dw1	
68	GF1		O.BL		4	3	gr2	
69	L3		R.HG		8	5	wt3	wt5a
70	GF1		O.BL		4	4	cd1	
71	MGF1		O.BL		4	3	dw3	
72	F1	MGF1	CA.BL		5	4	dw2	
73	L2		O.HG	O.BL	6	4	dw2	
74	F1		GLR.BL	O.BL	5	4	sh1	
75	M2		O.BL		4	4	sh1	dw2
76	M3		O.BLthin		3	3	gr3	
77	M1		O.BL		4	4	gr2	sh2
78	F1		GLR.BL		6	4	sh1	
79	M1		O.BL		4	4	dw1	
80	L2		O.HG		7	4	wt1	sh1
81	M1		O.BL		4	4	dw3	
82	M1		O.BL		4	3	sh2	
83	M1		O.BL		4	4	dw3	

*PM - codes for dominant and secondary physical land unit types; refer to Appendix B
SOIL1, SOIL2 - codes from Canada Soil Survey (1987)
MOIST. - Moisture Regime Codes:
1-xeric, 2-subxeric, 3-submesic, 4-mesic, 5-subhygric, 6-hygric, 7-subhydric, 8-hydric;
NUTR. - Nutrient Regime Codes:
1-oligotrophic, 2-submesotrophic, 3-mesotrophic, 4-permesotrophic, 5-eutrophic, 6-hypereutrophic
VEG1 - dominant and secondary vegetation types; refer to Appendix C

APPENDIX B. Descriptions of physical land unit codes from Appendix A and Map 1 - Police Outpost Provincial Park and Outpost Wetlands Natural Area.

PM UNIT CODE	PARENT MATERIALS	SOIL CLASS*	SLOPE (%)	DRAINAGE CLASS	MOISTURE REGIME	NUTRIENT REGIME	VEGETATION - summary	SITES
MORAINAL								
M1	Undulating and gently inclined till blankets	O.BL; O.BL thick	2-9	Well	Mesic	Mesotrophic	Forb-rich fescue grassland with scattered shrubs - mainly shrubby cinquefoil, rose and buckbrush	2,3, 6
M2	Nearly level to undulating till deposits	O.BL	1-9	Moderately well	Mesic	Permesotrophic	Poplar woods and hayfields	4,9, 12, 13,R2, R3
M3	Hummocky till veneers over bedrock	O.BL	16-40	Well	Submesic	Mesotrophic	Idaho fescue - Parry oatgrass -rough fescue;	1, R7, R9
MORAINE AND GLACIOFLUVIAL								
MGF1	Hummocky till veneers and blankets interspersed with stony glaciofluvial deposits	O.DB	10-30	Well to moderately well	Mesic	Permesotrophic	Mostly aspen forest; small areas of fescue or smooth brome grassland	R13
MORAINE AND RESIDUAL								
MX1	Morainal and residual veneers over inclined bedrock	R.BL (dominant); O.R; minor amounts of O.BL	31-45	Rapid to well	Subxeric to submesic	Submesotrophic to mesotrophic	Juniper and bearberry with Idaho fescue in poorly developed soils; forb-rich fescue grasslands (with balsam-root) in richer soils	8,14
MORAINE AND COLLUVIAL								
MC1	Inclined till deposits on lower slopes receiving slopewash	O.BL very thick	6-9	Moderately well to well	Mesic	Mesotrophic to permesotrophic	Forb-rich fescue grassland; scattered shrubby copses	15

FLUVIAL								
F1	Fluvial veneers over till; deposited by intermittent streams	O.HG (dominant), R.G and CA.BL	1-5	Imperfectly to poorly	Subhygric	Permesotrophic	Willows; balsam poplar woods	R5, R10
LACUSTRINE								
L1	Lacustrine veneers over undulating till deposits; slightly alkaline lake and pond sediments	O.HR and GLR.BL;	0-2	Poorly	Subhydric	Hypereutrophic	Grasses and forbs - many salt-tolerant species	11,R6, near R8
L2	Lacustrine veneers over undulating till deposits; lake and pond sediments	O.HG	0-2	Poorly	Subhydric	Eutrophic	Grass-sedge or willow/grass-sedge	10, R1, R8
L3	Lacustrine deposits over glaciofluvial deposits; glacial outwash channel now occupied by Outpost Wetland	R.G; R.HG and TH.F	0-2	Poorly to very poorly	Hydric	Eutrophic	Aquatic vegetation: sedges, swamp horsetail, cattail and rushes; willow especially at wetland edges	19, 20, 21
GLACIOFLUVIAL								
GF1	Glaciofluvial deposits on a dissected terrace adjacent to the Outpost Wetlands	O.BL thick	6-15	Well	Mesic	Mesotrophic	Grassland: rough fescue-bluegrass; large patches of smooth brome	R11, R12, 16,17
GF2	Glaciofluvial deposits (dominant), interspersed with recent fluvial deposits	O.BL thick	6-15	Moderately well	Mesic	Permesotrophic	Grassland- mostly smooth brome	R4

* codes for soil classification are from the Canadian System of Soil Classification (Canada Soil Survey 1987

APPENDIX C. Descriptions of vegetation mapping codes from Appendix A and Map 1 - Police Outpost Provincial Park and Outpost Wetlands Natural Area.

CODE	VEGETATION DESCRIPTION
Native grassland	
gr1	rough fescue-Parry oat grass- Idaho fescue
gr2	rough fescue - Kentucky bluegrass
gr3	Idaho fescue - Parry oatgrass - rough fescue
Cultivated/disturbed (dominated by non-native species)	
cd1	cultivated; tame or non-native species
cd2	non-native species with some native forbs
Shrublands	
sh1	beaked willow /baneberry
sh2	saskatoon-common wild rose/ bluegrass-rough fescue
sh3	silverberry
sh4	creeping juniper/timothy - Kentucky bluegrass
sh5	creeping juniper- common bearberry/ rough fescue
Deciduous woodlands	
dw1	aspen/ snowberry
dw2	balsam poplar-aspen/willow/cow parsnip
dw3	aspen/Kentucky bluegrass-smooth brome
Wetlands	
wt1	wetland meadow (fowl bluegrass – wire rush)
wt2	slightly saline meadow (tufted hair grass – Nuttall's salt-meadow grass)
wt3	willow/beaked sedge
wt4	sedge wetland (water sedge – beaked sedge)
wt5	aquatic emergents (deep marsh) a – cattail, bulrush b – swamp horsetail

APPENDIX D. Scientific and common names of plant species observed at Police Outpost Provincial Park and Outpost Wetlands Natural Area, 1997.

Latin name	Common name	Family
Achillea millefolium	Common yarrow	Compositae
Actaea rubra	Red/white baneberry	Ranunculaceae
Agoseris glauca	Yellow false dandelion	Compositae
Agropyron dasystachyum	Northern wheat grass	Gramineae
Agropyron smithii	Western wheat grass	Gramineae
Agropyron trachycaulum	Slender wheat grass	Gramineae
Allium schoenoprasum	Wild chives	Liliaceae
Allium textile	Prairie onion	Liliaceae
Amelanchier alnifolia	Saskatoon	Rosaceae
Androsace septentrionalis	Northern fairy candelabra	Primulaceae
Anemone multifida	Cut-leaved anemone	Ranunculaceae
Anemone patens	Prairie crocus	Ranunculaceae
Angelica arguta	White angelica	Umbelliferae
Antennaria anaphaloides	Tall everlasting	Compositae
Antennaria parvifolia	Small-leaved everlasting	Compositae
Apocynum androsaemifolium	Spreading dogbane	Apocynaceae
Arctostaphylos uva-ursi	Common bearberry	Ericaeae
Arnica fulgens	Shining arnica	Compositae
Artemisia frigida	Pasture sagewort	Compositae
Aster falcatus	Creeping white prairie aster	Compositae
Aster spp	Aster	Compositae
Astragalus dasyglottis	Purple milk vetch	Leguminosae
Balsamorhiza sagittata	Balsamroot	Compositae
Betula occidentalis	Water birch	Betulaceae
Bouteloua gracilis	Blue grama	Gramineae
Bromus carinatus	Keeled brome	Gramineae
Bromus inermis	Smooth brome	Gramineae
Bromus vulgaris	Woodland brome	Gramineae
Calamagrostis canadensis	Bluejoint	Gramineae
Calamagrostis inexpansa	Northern reed grass	Gramineae
Calamagrostis montanensis	Plains reed grass	Gramineae

Calamovilfa longifolia	Sand grass	Gramineae
Camassia quamash	Blue camas	Liliaceae
Carex aquatilis	Water sedge	Cyperaceae
Carex atherodes	Awned sedge	Cyperaceae
Carex bebbii	Bebb's sedge	Cyperaceae
Carex lanuginosa	Woolly sedge	Cyperaceae
Carex obtusata	Blunt sedge	Cyperaceae
Carex utriculata	Beaked sedge	Cyperaceae
Carex stenophylla	Low sedge	Cyperaceae
Cerastium arvense	Field mouse-ear chickweed	Caryophyllaceae
Cirsium arvense	Canada thistle	Compositae
Cirsium hookerianum	White thistle	Compositae
Comandra umbellata	Bastard toadflax	Santalaceae
Cornus stolonifera	Red-osier dogwood	Cornaceae
Cryptantha nubigena	Clustered oreocarya	Boraginaceae
Danthonia parryi	Parry oat grass	Gramineae
Delphinium bicolor	Low larkspur	Ranunculaceae
Deschampsia cespitosa	Tufted hair grass	Gramineae
Disporum trachycarpum	Fairybells	Liliaceae
Districhlis stricta	Salt grass	Gramineae
Dodecatheon conjugens	Mountain shooting-star	Primulaceae
Elaeagnus commutata	Silverberry	Elaeagnaceae
Epilobium angustifolium	Common fireweed	Equisetaceae
Equisetum arvense	Common horsetail	Equisetaceae
Equisetum fluviatile	Swamp horsetail	Equisetaceae
Equisetum laevigatum	Smooth scouring-rush	Equisetaceae
Equisetum palustre	Marsh horsetail	Equisetaceae
Erigeron caespitosus	Tufted fleabane	Compositae
Erigeron compositus	Compound-leaved fleabane	Compositae
Eriogonum flavum	Yellow umbrella-plant	Polygonaceae
Festuca idahoensis	Idaho fescue	Gramineae
Festuca campestris	Rough fescue	Gramineae
Fragaria virginiana	Wild strawberry	Rosaceae
Gaillardia aristata	Gaillardia	Compositae
Galium boreale	Northern bedstraw	Rubiaceae
Galium triflorum	Sweet-scented bedstraw	Rubiaceae

Geranium richardsonii	Wild white geranium	Geraniaceae
Geranium viscossisimum	Sticky purple geranium	Geraniaceae
Geum aleppicum	Yellow avens	Rosaceae
Geum macrophyllum	Large-leaved yellow avens	Rosaceae
Geum rivale	Purple avens	Rosaceae
Geum triflorum	Three-flowered avens	Rosaceae
Grindelia squarrosa	Gumweed	Compositae
Habenaria viridis	Bracted bog orchid	Orchidaceae
Hackelia jessicae	Jessica's stickseed	Boraginaceae
Haplopappus uniflorus	One-flowered ironplant	Compositae
Hedysarum sulphurescens	Yellow hedysarum	Leguminosae
Heracleum lanatum	Cow parsnip	Umbelliferae
Heterotheca villosa	Golden aster	Compositae
Heuchera parvifolia	Small-leaved alumroot	Saxifragaceae
Heuchera richardsonii	Richardson's alumroot	Saxifragaceae
Hierochloe odorata	Sweet grass	Gramineae
Hippuris vulgaris	Common mare's-tail	Hippuridaceae
Hymenoxys acaulis	Butte marigold	Compositae
Juncus balticus	Wire rush	Juncaceae
Juniperus horizontalis	Creeping juniper	Cupressaceae
Koeleria macrantha	June grass	Gramineae
Lathyrus ochroleucus	Yellow peavine	Leguminosae
Liatris punctata	Blazing star	Compositae
Linum lewisii	Wild blue flax	Linaceae
Lithospermum ruderale	Woolly gromwell	Boraginaceae
Lomatium triternatum	Western wild parsley	Umbelliferae
Lonicera dioica	Twining honeysuckle	Caprifoliaceae
Lupinus sericeus	Perennial lupine	Leguminosae
Moehringia lateriflora	Blunt-leaved sandwort	Caryophyllaceae
Monarda fistulosa	Wild bergamot	Labiatae
Myriophyllum exalbescens	Spiked water-milfoil	Haloragaceae
Osmorhiza chilensis	Blunt-fruited sweet cicely	Umbelliferae
Osmorhiza depauperata	Spreading sweet cicely	Umbelliferae
Oxytropis sericea	Early yellow locoweed	Leguminosae
Paronychia sessiliflora	Low whitlow-wort	Caryophyllaceae
Penstemon confertus	Yellow beardtongue	Scrophulariaceae

Penstemon nitidus	Smooth blue beardtongue	Scrophulariaceae
Phleum commutatum	Mountain timothy	Gramineae
Phleum pratense	Timothy	Gramineae
Phlox alyssifolia	Blue phlox	Polemoniaceae
Phlox hoodii	Moss phlox	Polemoniaceae
Picea glauca	White spruce	Pinaceae
Poa interier	Inland bluegrass	Gramineae
Poa palustris	Fowl bluegrass	Gramineae
Poa pratensis	Kentucky bluegrass	Gramineae
Polygonum amphibium	Water smartweed	Polygonaceae
Populus tremuloides	Aspen	Salicaceae
Populus balsamifera	Balsam poplar	Salicaceae
Potamogeton pectinatus	Sago pondweed	Potamogetonaceae
Potamogeton richardsonii	Clasping-leaf pondweed	Potamogetonaceae
Potentilla anserina	Silverweed	Rosaceae
Potentilla arguta	White cinquefoil	Rosaceae
Potentilla concinna	Early cinquefoil	Rosaceae
Potentilla fruticosa	Shrubby cinquefoil	Rosaceae
Potentilla gracilis	Graceful cinquefoil	Rosaceae
Potentilla hippiana	Woolly cinquefoil	Rosaceae
Potentilla pensylvanica	Prairie cinquefoil	Rosaceae
Prunus virginiana	Choke cherry	Rosaceae
Puccinellia nuttalliana	Nuttall's salt-meadow grass	Gramineae
Pyrola asarifolia	Common pink wintergreen	Pyrolaceae
Ranunculus cardiophyllus	Heart-leaved buttercup	Ranunculaceae
Ranunculus circinatus	Firm white water crowfoot	Ranunculaceae
Ribes inerme	Mountain gooseberry	Grossulariaceae
Ribes oxyacanthoides	Northern gooseberry	Grossulariaceae
Rosa acicularis	Prickly rose	Rosaceae
Rosa woodsii	Common wild rose	Rosaceae
Rumex occidentalis	Western dock	Polygonaceae
Salix bebbiana	Beaked willow	Salicaceae
Salix discolor	Pussy willow	Salicaceae
Salix exigua	Sandbar willow	Salicaceae
Salix maccalliana	Velvet-fruited willow	Salicaceae
Salix myrtillifolia	Myrtle-leaved willow	Salicaceae

Salix pseudomonticola	False mountain willow	Salicaceae
Sanicula marilandica	Snakeroot	Umbelliferae
Selaginella densa	Prairie selaginella	Selaginaceae
Senecio canus	Prairie groundsel	Compositae
Senecio foetidus	Marsh butterweed	Compositae
Sisyrinchium montanum	Blue-eyed grass	Iridaceae
Sium suave	Water parsnip	Umbelliferae
Smilacina stellata	Star-flowered Solomon's seal	Liliaceae
Solidago missourienses	Low goldenrod	Compositae
Stipa richardsonis	Richardson needle grass	Gramineae
Symphoricarpos albus	Snowberry	Caprifoliaceae
Symphoricarpos occidentalis	Buckbrush	Caprifoliaceae
Taraxacum officinale	Common dandelion	Compositae
Thalictrum venulosum	Veiny meadow rue	Ranunculaceae
Thermopsis rhombifolium	Golden bean	Leguminosae
Tomenthypnum nitens	Golden moss	Brachytheciaceae
Trifolium repens	White clover	Leguminosae
Triglochin maritima	Seaside arrow-grass	Juncaginaceae
Urtica dioica	Common nettle	Urticaceae
Valerian dioica	Northern valerian	Valerianaceae
Vicia americana	Wild vetch	Leguminosae
Viola adunca	Early blue violet	Violaceae
Viola nephrophylla	Bog violet	Violaceae
Viola nuttallii	Yellow prairie violet	Violaceae
Zigadenus elegans	White camas	Liliaceae
Zigadenus venenosus	Death camas	Liliaceae
Zizia aptera	Heart-leaved alexanders	Umbelliferae

APPENDIX E. Comparison of native upland vegetation community types found in this study to other defined community types in southwest Alberta.

This Study	**Porcupine Hills (Jaques 1979)**	**Montane Subregion (Willoughby et al.1998)**	**Upper Bob Creek (Cornish 1997)**
Aw/snowberry	---	Aw/snowberry-saskatoon	---
Pb-Aw/willow/ cow parsnip	---	Pb/cow parsnip/ Kentucky bluegrass	---
Aw/Kentucky bluegrass- smooth brome	---	Aw/snowberry /Kentucky bluegrass	---
Beaked willow/baneberry	---	Beaked willow / hairy wild rye	---
Saskatoon-rose /Kentucky bluegrass –rough fescue	Rough fescue–Parry oatgrass/ sticky purple geranium: rose –snowberry -saskatoon dominant	---	---
	---	---	
Creeping juniper – common bearberry/rough fescue	Rough fescue–Parry oatgrass-Idaho fescue: creeping juniper phase	Rough fescue – sedge/ bearberry	---
Rough fescue – Parry oatgrass – Idaho fescue	Rough fescue–Parry oatgrass-Idaho fescue	Rough fescue – Idaho fescue – Parry oatgrass	Rough fescue – Idaho fescue – Parry oatgrass
Idaho fescue – Parry oatgrass – rough fescue	Rough fescue–Parry oatgrass-Idaho fescue: Idaho fescue phase	Idaho fescue – Parry oatgrass – rough fescue	Idaho fescue – Parry oatgrass – Rough fescue
Rough fescue – Kentucky bluegrass	---	Kentucky bluegrass – rough fescue	Kentucky bluegrass – rough fescue

APPENDIX F. Ranking system used to evaluate status of significant plant species. The system was originally developed by The Nature Conservancy, and is presented in ANHIC (1996). Only the ranks for species discussed in this report are included here.

Rank	Definition
S1	Five or fewer occurrences or only a few remaining individuals or may be imperiled because some factor of its biology makes it especially vulnerable to extirpation.
S2	6-20 occurrences or with many individuals in fewer occurrences; or may be susceptible to extirpation because of some factor of its biology.
S3	21-100 occurrences, may be rare and local throughout its range, or in a restricted range (may be abundant in some locations or may be vulnerable to extirpation because of some factor of its biology).
SU	Status uncertain often because of low search effort or cryptic nature of the element; possibly in peril

APPENDIX G. Definitions of risk categories at national (COSEWIC 1996) and provincial (Alberta Environmental Protection 1996) levels, which were used to evaluate status of fauna in the study area.

I. COSEWIC (Committee on the Status of Endangered Wildlife in Canada 1996) assigns status of wildlife species into one of the following categories:

Status	Definition
Extinct	A species that no longer exists
Extirpated	A species no longer existing in the wild in Canada, but occurring elsewhere
Endangered	A species facing imminent extirpation or extinction
Threatened	A species likely to become endangered if limiting factors are not reversed
Vulnerable	A species of specieal concern because of characteristics that make it particularly sensitive to human activities or natural events

II. Alberta Environmental Protection (1996) uses the following evaluation system:

Status	Definition
Red-listed	Populations of these species have declined, or are believed to have declined, to nonviable levels, or show a rate of decrease indicating that they are at immediate risk of declining to nonviable levels in Alberta
Blue-listed	These species are also at risk but the threats that they face are less immediate. This list includes species which are particularly vulnerable because of non-cyclical declines in population or habitat, or reductions in provincial distribution
Yellow A-listed	Yellow A-listed species are sensitive species which may require special management to address concerns related to naturally low populations, limited provincial distributions or life history features that make them vulnerable to human-related changes to the environment. Yellow A-listed species are those for which concern has been expressed over long-term declines in numbers.
Yellow B-listed	Yellow B-listed species are those which are naturally rare but not in decline, or are associated with habitats or habitat elements that may be deteriorating.

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